INTERACTIVE BATTLING ROBOTS WITH UNIVERSAL VEHICLE CHASSIS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims benefit of United States Provisional Application Number 60/266,958, filed February 6, 2001.

BACKGROUND OF THE INVENTION

The present invention relates to infrared (IR) remote control vehicles having multiple body styles operable with a universal chassis with attachable dynamic assemblies, and more particularly to robotic vehicles that can accept one or more different weapon assemblies operable from the drive motors of the universal chassis.

It would be desirable to provide a modular chassis system for children facilitating the customization or modification of overall vehicle designs and allowing for the configuration of robotic vehicles which may include mechanical subassemblies such as weaponry providing a play pattern as between remote control vehicles operable simultaneously such that overall functionality may be removed or limited based on collisions or damages taken on by the vehicles.

SUMMARY OF THE INVENTION

Briefly summarized, the present invention provides a universal chassis which may be assembled with modular componentry allowing for a play pattern with the user in which modification of the overall construction of the vehicle is encouraged. There is a desire therefore to provide for the ability to accept a variety of snap-on components. In operating the configured vehicle, two motors, i.e., left and right, are provided with pulsed controlled operation to facilitate two-speed performance. The ability to transmit/receive IR signals modulated on one or more of multiple carriers facilitates the play pattern with simultaneous operation of multiple vehicles.

An impact sensor or the like provides for detecting impacts, and processor control may be used for counting impacts in order to modify the functionality accorded to the user with the universal chassis.

Advantageously, snap-on mechanical subassemblies may be powered from either of the two motors of the universal chassis such that operation of either motor may operate the snap-on mechanical subassembly which may be provided as a weapon or the like as use by the robotic vehicle. The controller onboard the chassis controls all functionality of the chassis and may also provide for the detection of the presence or absence of any mechanical subassemblies. Additionally, interlocks or clutch mechanisms may be provided with the mechanical subassemblies for safety and reliability of the configured vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention is obtained when considered in connection with the following description, drawings and software Appendix (A-1 through A-8), in conjunction with the following figures, in which:

FIGURE 1 illustrates an exploded view of a basic universal chassis in accordance with the present invention;

FIGURES 2A-2J, FIGURES 3A-3J, FIGURES 4A-4J, and FIGURES 5A-5J respectively illustrate four (4) robotic vehicle embodiments illustrating various subassemblies corresponding to associated assemblies as between the embodiments of the FIGS. 2-5, with a total assembly illustrated as (A) and subassemblies (B)-(J);

FIGURE 6 is a schematic diagram of the transmitter electronics provided in a hand-held controller; and

FIGURES 7A-7C are schematic diagrams of the electronic circuitry in the universal chassis in which FIG. 7A shows the IR receiver circuitry and FIGS. 7B and 7C shows the H bridge motor control circuitry for the chassis

motors in which FIG. 7B controls the left-hand motor and FIG. 7C controls the right-hand motor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1, the universal chassis for the preferred embodiments is provided as an IR controlled vehicle chassis which facilitates multiple functionality including the provision of a dual motor, dual speed, remote control vehicles that accommodate multiple modular wheel, weapon and body assemblies which may be received on the universal chassis of FIG. 1. As described, the chassis is further equipped with on-board electronics for receiving encoded IR signals for controlling the speed of the left-hand and right-hand motors respectively, and microprocessor control is provided for counting the number of physical impacts as identified with an impact switch or tilt sensor.

IR Battlebots are described as a variety of dual motor, dual speed, remote controlled vehicles having a universal chassis with the means for accepting modular wheel, weapon and body assemblies and where the chassis is also equipped with the on board electronics for receiving an IR signal, for controlling the speed of the motors, and for counting the number of physical impacts received. The controller has the means of transmitting via IR any one of 17 codes required for the operation of the vehicles. These functions are forward and reverse for both motors and "turbo" forward and reverse for both motors. There is also a code for when the vehicle is idle. The IR itself is broadcast at one specific carrier frequency.

Both the chassis and the controller may be outfitted with a switch for changing the specific IR carrier broadcast frequency. The number possible switch positions is determined by the number of Battlebots (chassis) required to battle simultaneously.

Alternatively, each Battlebot (chassis) may be tuned to a single specific IR carrier frequency. In this event, two of the same style Battlebots (chassis) will not be able to operate simultaneously.

To clarify further, any chassis may become any Battlebot because of the modular nature of its construction. The modularity is purposely built in to allow users to modify their Battlebot chassis.

A hand-held controller (not shown) is facilitated with the ability to transmit via IR signals nine codes which facilitate 17 operations of the motor as illustrated Appendix A-1 through A-8. The decoding of the 17 encoded operations for the motor drive combinations of the vehicles facilitates the functions of forward, reverse, and turbo drive commands for either or both motors including turbo forward and reverse for both motors. A code is also provided for indicating when the vehicle is in an idle state when the user has not manipulated the controls of the hand-held controller such that the vehicle motor may be provided in an OFF state. Additionally, the IR carrier frequency is broadcast by individual controllers at separate carrier frequencies allowing for the control and operation of multiple vehicles simultaneously by different users.

To this end, the controller and the chassis may be outfitted with a switch, e.g., rotatable, momentary or dip switches, for changing the specific IR broadcast frequencies. The number of possible switch positions or frequency configurations may be determined by the number of vehicles required to battle or otherwise operate simultaneously. Alternatively, each chassis may be tuned to a single specific IR carrier frequency, in which two of the same style chassis may not be able to operate simultaneously.

The configured vehicles are intended for operation at relatively close range with directional infrared IR controllers such that multiple players may engage in a battle or collision activity between multiple vehicles. The operation may be provided either on a tabletop or on a flat floor surface for providing a platform for engaging the play pattern as

between the players and their controlled vehicles. It is likely that the players will be operating the vehicles within close range, e.g., 3 to 10 feet, preferably at a range of about six feet. As shown in FIG. 1, the universal chassis includes electronic circuitry on a circuit board including an IR receiver, impact switch, an LED indicator and reset button operable with batteries housed within the chassis. Each of two motors (left and right) have a combination gear which operates the driver train and weapon subassemblies. As discussed, the assemblies of FIGS. 2A, 3A, 4A, and 5A facilitate operation from either of the two motors that will activate the weapon subassemblies such that slider gears in FIGS. 2J, 3J, 4J, and 5J may individually operate the mechanical subassemblies attached to the universal chassis.

As discussed, the universal chassis accepts modular components and includes four bosses to accept any of the four bodies, or body styles of FIGS. 2G, 3G, 4G, and 5G, identified by name by Minion, Blendo, Killerhurtz, and Vlad, body styles, respectively. The reversible motors are provided with two speeds either for pulsed operation from the information processor facilitated with a microprocessor or microcontroller, which controls the speed by providing a pulsed or alternatively a full power ("turbo") operation. In addition to providing for slower pulsed operation, the pulsed operation of the motor also serves to extend the battery life of the vehicle, and the slow pulsed operation is also a provided mode of operation for steering or otherwise maneuvering the vehicles.

The IR controller is operated on one of multiple carrier frequencies, at least three and preferably four to eight frequencies for allowing simultaneous operation, e.g., eight vehicles over eight carrier frequencies, which are controlled with a frequency configuration switch or input provided by the user. The infrared (IR) transmission link is somewhat directional with the remote hand-held controllers providing an angle of illumination of about 40 degrees allowing for multiple players in indoor closer range

operation. The transmit and receive circuitries are described further below in connection with FIGS. 6 and 7A and 7B which are provided with a conventional Winbond W583 encoding circuit which transmits signals over a carrier frequency generated with a 555 timer.

The mechanical subassemblies are illustrated in exploded views for each of the four embodiments, as shown in FIGS. 2J, 3J, 4J, and 5J, respectively, providing a saw operation, a rotary dome with serrated teeth, a hatchet, and forklift type assemblies, however, various other active assemblies may be operable from the universal chassis.

Turning now to FIG. 6, the Winbond W583 encoder circuit which is used both in the transmitter circuit of FIG. 6 and receiver circuit of FIG. 7A, provides for modulation as indicated in the hardware IR of Appendix A-1, which is facilitated with the software control IR transmitter program of Appendix A-2 through A-5 and the IR receiver program of A-6 through A-8. As shown in FIG. 6, the IR output of the W583 integrated circuit is coupled via a transmitter to the 555 timer, which outputs a modulated carrier frequency from a IR LED under the control of a switching transistor. Codes indicated in accordance with Appendix A-1 are thus transmitted from the transmitter circuitry of FIG. 6. The typical operation for the 555 timer provides a carrier output of approximately 38 kilohertz which may be varied for operation on multiple different carriers.

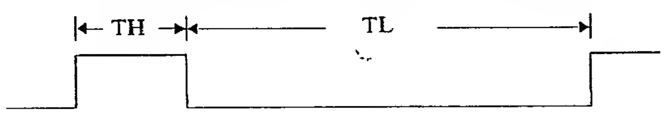
With reference to FIG. 7A, the IR receiver includes a photo diode with a tuner adjustment stage (optional) followed by a two-stage operational amplifier for amplifying the detected IR signal which is presented to a phase-lock loop (PLL) tone decoder herein LM567 decoder which generates an output to the Winbond W583 integrated circuit for controlling the OR GATE operation of the H bridge motor circuitry of FIGS. 7B and 7C, which are provided as conventional motor drive circuits. It will be appreciated that the 555 timer of the FIG. 7A receiver provides gated operation such that

the turbo decode output resets the 555 timer so as to provide full power operation to the motors via the control circuitry of FIGS. 7B and 7C.

While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

VI.12.1 H/W IR Protocol

The output protocol of hardware defined IR begins with a Start bit followed by 9 Data bits(1 data byte, MSB first, and 1 parity bit), and Stop bit. The Start bit is typically composed of 1mS High(TH) and 6.5mS Low(TL). Data bit '1' is composed of 1mS High and 4mS Low. Data bit '0' and Stop bit are composed of 1mS High and 2mS Low. It's called pulse position modulation. The IROUT pin will keep high in TH duration and output 38 KHz carrier with 75% duty cycle in TL duration. Receiver module will recover the original waveform by filtering the 38 KHz carrier out.



Parameter	Description	Min.	Typ.	Max.	Unit
TD0	Data "0" period		3000		µS
THD0	Data "0" high time	800	1000	1200	µS
TLD0	Data "0" low time	1600	2000	2400	µS
TD1	Data "1" period		5000		µS
THD1	Data "1" high time	800	1000	1200	µS
TLD1	Data "1" low time	3200	4000	4800	µS
TSTR	Start bit period		7500		µS
THSTR	Start bit high time	800	1000	1200	µS
TLSTR	Start bit low time	5200	6500		µS

VI.13 CPU INTERFACE

The W583xxx can communicate with an external microprocessor through a simple serial CPU interface. This

```
;       Battle Bots
;
;       BBOT_T2        IR transmitter program
;
;
;
;
        W583S40
              DEFPAGE 1
        NORMAL
              OSC_3MHZ
              VOUT_DAC
              LED0
              FREQ2
32:
              LD EN0,10111011b
        LD EN1,00110011b
              LD R0,0
        LD MODE0,10111111B        ;STP C control IR
        LD MODE1,0FEH             ;IR carrier disabled
        END

0:      ;TG1 is low
        ;ignore TG2
        [10]
        JP 40@TG6_LOW
        JP 41@TG4_LOW
        JP 42@TG5_LOW
;       LD STOP,11111011b
;       [500]
;       LD STOP,11111111b
;       [500]
;       LD STOP,11111011b
;       [500]
;       LD STOP,11111111b
;       [500]
;       LD STOP,11111011b
;       [500]
;       LD STOP,11111111b
;       [500]
;       LD STOP,11111011b
;       [500]
;       LD STOP,11111111b
;       [500]
        LD R0,33              ;left turn
        JP 110
1:      ;ignore TG1
        ;TG2 is low
        [10]
        JP 45
9:      ;TG6 is low
        ;ignore TG4
        [10]
        JP 40@TG1_LOW
        JP 49@TG2_LOW
        JP 46
3:      ;ignore TG6
```

```
        ;TG4 is low
        [10]
        JP 41@TG1_LOW
        JP 50@TG2_LOW
        JP 47
4:      ;TG1 returns high
        [10]
        JP 45@TG2_LOW
        JP 46@TG6_LOW
        JP 47@TG4_LOW
        LD R0,49               ;stop
        JP 110
5:      ;TG2 returns high
        [10]
        JP 0@TG1_LOW
        JP 46@TG6_LOW
        JP 47@TG4_LOW
        LD R0,49               ;stop
        JP 110
13:     ;TG6 returns high
        [10]
        JP 0@TG1_LOW
        JP 45@TG2_LOW
        JP 47@TG4_LOW
        LD R0,49               ;stop
        JP 110
7:      ;TG4 returns high
        [10]
        JP 0@TG1_LOW
        JP 45@TG2_LOW
        JP 46@TG6_LOW
        LD R0,49               ;stop
        JP 110
8:      ;TG5 is low
        [10]
        JP 0@TG1_LOW
        JP 45@TG2_LOW
        JP 46@TG6_LOW
        JP 47@TG4_LOW
        LD R0,49               ;stop
        JP 110
12:     ;TG5 returns high
        [10]
        JP 0@TG1_LOW
        JP 1@TG2_LOW
        JP 9@TG6_LOW
        JP 3@TG4_LOW
        LD R0,49               ;stop
        JP 110
40:     ;TG1 is low
        ;TG6 is low
        JP 43@TG5_LOW
        LD R0,40               ;forward
        JP 110
41:     ;TG1 is low
        ;TG4 is low
        JP 44@TG5_LOW
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```
        LD R0,37            ;ccw spin
        JP 110
42:     ;TG1 is low
        ;TG5 is low
        LD R0,41            ;turbo left turn
        JP 110
43:     ;TG1 is low
        ;TG6 is low
        ;TG5 is low
        LD R0,48            ;turbo forward
        JP 110
44:
        LD R0,45            ;turbo ccw spin
        JP 110
45:     ;TG2 is low
        JP 49@TG6_LOW
        JP 50@TG4_LOW
        JP 51@TG5_LOW
        LD R0,34            ;reverse left turn
        JP 110
46:     ;TG1 is high
        ;TG2 is high
        ;TG6 is low
        JP 54@TG5_LOW
        LD R0,35            ;right turn
        JP 110
47:     ;TG1 is high
        ;TG2 is high
        ;TG6 is high
        ;TG4 is low
        JP 55@TG5_LOW
        LD R0,36            ;reverse right turn
        JP 110
48:     ;TG1 is high
        ;TG2 is high
        ;TG6 is high
        ;TG4 is high
        ;TG5 is low
        LD R0,49            ;stop
        JP 110
49:     ;TG2 is low
        ;TG6 is low
        JP 52@TG5_LOW
        LD R0,38            ;cw spin
        JP 110
50:     ;TG2 is low
        ;TG4 is low
        JP 53@TG5_LOW
        LD R0,39            ;reverse
        JP 110
51:     ;TG2 is low
        LD R0,42            ;turbo reverse left turn
        JP 110
52:     ;TG2 is low
        ;TG6 is low
        ;TG5 is low
        LD R0,46            ;turbo cw spin
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```
        JP 110
53:     ;TG2 is low
        ;TG4 is low
        ;TG5 is low
        LD R0,47            ;turbo reverse
        JP 110
54:     ;TG1 is high
        ;TG2 is high
        ;TG6 is low
        ;TG5 is low
        LD R0,43            ;turbo right turn
        JP 110
55:     ;TG1 is high
        ;TG2 is high
        ;TG6 is high
        ;TG4 is low
        ;TG5 is low
        LD R0,44            ;turbo reverse right turn
        JP 110
110:
        [300]
        TX  R0
        [100]
        TX  R0
              ;[1000]
        [400]
        JP 110


2:
60:
100:
10:
11:
6:
14:
15:
...

255:

          jp 32
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```
;       Battle Bots
;
;       BBOT_R2         IR receiver program
;
;
;
;
W583S40
DEFPAGE 1
NORMAL
OSC_3MHZ
VOUT_DAC
LED0
FREQ2               ;8KHZ
POI:
            LD EN0,0
            LD EN1,0
;            LD MODE0,0bFH
;       LD MODE0,00111111b      ;led1 DC,stpc output
        LD MODE0,00101111b      ;led1 DC,stpc output,short debounce
;            LD MODE1,0FFH
        LD MODE1,11111111b
;            LD STOP,0FFH
            LD STOP,07FH
        LED1                ;;led1 on
            [400]
;            LD EN0,00H
        LD EN1,00001000b        ;TG8 negative edge triggered for jiggle switch
;       LD EN1,00000000b        ;TG8 negative edge triggered for jiggle switch
DISABLED
        LD R0,50
            JP 100

11:
        JP R0

100:
            [880]
        LD STOP,01111111b
        JP 101
        END
101:
            [880]
        LD STOP,01111111b
        JP 102
        END
102:
            [880]
        LD STOP,01111111b
        JP 103
        END
103:
            [880]
        LD STOP,01111111b
        JP 104
        END
104:
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```
          [880]
      LD STOP,01111111b
      JP 105
      END
105:
          [880]
      LD STOP,01111111b
      JP 106
      END
106:
          [880]
      LD STOP,01111111b
      JP 107
      END
107:
          [880]
      LD STOP,01111111b
      JP 108
      END
108:
          [880]
      LD STOP,01111111b
      JP 109
      END
109:
          [880]
      LD STOP,01111111b
          JP 100
      END
33:
      LD STOP,01111110b
      JP 100
34:
      LD STOP,01111101b
      JP 100
35:
      LD STOP,01011111b
      JP 100
36:
      LD STOP,01110111b
      JP 100
37:
      LD STOP,01110110b
      JP 100
38:
      LD STOP,01011101b
      JP 100
39:
      LD STOP,01110101b
      JP 100
40:
      LD STOP,01011110b
      JP 100

41:
      LD STOP,01101110b
      JP 100
```

```
42:
        LD STOP,01101101b
        JP 100
43:
        LD STOP,01001111b
        JP 100
44:
        LD STOP,01100111b
        JP 100
45:
        LD STOP,01100110b
        JP 100
46:
        LD STOP,01001101b
        JP 100
47:
        LD STOP,01100101b
        JP 100
48:
        LD STOP,01001110b
        JP 100
49:
        LD STOP,01111111b
        JP 100
50:
        LD EN1,00000000b        ;disable all triggers
        LD STOP,11111111b ;disable IR input - npn base hi...npn on!
        LD R0,51
        LED1
        [1000]
        LD STOP,01111111b
        LD EN1,00001000b        ;TG8 negative edge triggered for jiggle switch
        JP 100
51:
        LD EN1,00000000b        ;disable all triggers
        LD STOP,11111111b ;disable IR input - npn base hi...npn on!
        LD R0,52
        LD MODE0,10111111b      ;led1 flash
        LED1
        [1000]
        LD STOP,01111111b
        LD EN1,00001000b        ;TG8 negative edge triggered for jiggle switch
        JP 100
52:
        LD EN1,00000000b        ;disable all triggers
        LD STOP,11111111b ;disable IR input - npn base hi...npn on!
        LED0              ;led1 off
53:
        JP 53
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